2017 TERMINAL 18 CAP INSPECTION REPORT

PORT OF SEATTLE TERMINAL 18
HARBOR ISLAND

Prepared for

Port of Seattle
2711 Alaskan Way
Seattle, WA 98121

March 14, 2018

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Maps

Acronyms

CD	consent decree
CIR	capping implementation report
EPA	US Environmental Protection Agency
GPS	global positioning system
I&M	inspection and maintenance
Port	Port of Seattle
RA	remedial action
ROD	Record of Decision
SOW	statement of work
SSA	SSA Marine, Inc.
T-18	Terminal 18
Windward	Windward Environmental LLC

1 Introduction

This report describes the 2017 Terminal 18 (T-18) cap inspection conducted by Windward Environmental LLC (Windward) on behalf of the Port of Seattle (Port) on December 14, 2017. The cap was implemented as part of a remedial action (RA) pursuant to consent decree (CD) Civil Action No. C95-1495-Z, the US Environmental Protection Agency (EPA) statement of work (SOW) (EPA 1996b), and the Amended Record of Decision (ROD) (EPA 1996a). The purpose of the cap, as stated in the ROD, is to prevent workers from coming into dermal contact with impacted soils, as well as to reduce the infiltration of rainwater to underlying soil.

This inspection report includes evaluations of the visible portions of the asphalt- and concrete-paved cap within the T-18 Port property (i.e., inspection area), as shown in Map A-1 (Appendix A). The purpose of the annual evaluations is to look for evidence of settlement, cracking, damage, or standing water more than 3 in. deep on surfaces and along structures, in order to evaluate the integrity of the cap and identify any areas of damage that may need repair. This report also includes evaluations of repairs made to previously observed cap issues (Appendix B). Cap construction was documented in the *Design Set #2 Capping Implementation Report* (CIR) (RETEC 2006), which included a plan for annual cap inspections to ensure that the cap continued to meet its stated performance objectives (Appendix C). The cap is depicted in Figure 3-1 from the CIR (Appendix D).

In preparation for potential future rehabilitation work at T-18 outfalls, soil and groundwater samples were collected this year by Floyd|Snider from within the T-18 cap area and the results are provided in Appendix E. These samples were obtained for the purpose of anticipating dewatering water and excavated material management needs. It is still not known if excavation will be required or if some or all of the outfall pipes can be repaired by sliplining or similar non-intrusive means. Additional information regarding sampling and specific analytes is provided in Appendix E.

Cap inspections have been conducted annually since 2007.[1] Inspection findings from 2007 through 2009 are described in *2007 Terminal 18 Cap Inspection Report* (ENSR|AECOM 2008) and *2008-2009 Terminal 18 Cap Inspection Report* (AECOM 2009). The 2010 through 2016 inspection findings are reported in Windward's cap inspection reports (Windward 2010, 2012, 2013, 2014, 2015, 2016, 2017).

The remainder of this report is organized as follows:

- Section 2: Inspection Method
- Section 3: Inspection Results
- Section 4: Conclusions and Needed Repairs

[1] The 2016 annual inspection was conducted in February 2017 (Windward 2017).

2 Inspection Method

The 2017 inspection was coordinated with the Port and primary tenant (SSA Marine, Inc. [SSA]) and was completed during the night of December 14, 2017. The inspection included the cap area south of the secure yard in the vicinity of the south entrance and the intermodal yard (Map A-1). Areas within the intermodal yard were inspected after the terminal had closed to optimize access and team safety. The inspection was conducted by members of a trained field team and covered all accessible designated roadways and parking/storage areas within the inspection area.

The inspection area boundary shown on Map A-1 (Appendix A) was developed by AECOM from Figure 3-1 of the CIR (Appendix D). The 200-by-200-ft grid overlay was used to track observations during the inspection. Not all parts of the inspection area were accessible due to the presence of containers or other equipment on the cap surface.

The general purpose of the annual inspection, pursuant to the inspection and maintenance (I&M) plan (Appendix C), is to identify areas of excessive cap settlement, cap pavement cracking or damage, and standing water on surfaces and along structures. Therefore, settlement, cracking, damage, and standing water were noted and photographed when observed. Global positioning system (GPS) coordinates were recorded for each observation. These observations are described in detail Section 3 and Appendix A.

As described herein, these observations were considered relative to established criteria (based on Table 5-1 in the CIR (RETEC 2006); see Appendix C) to determine whether maintenance should be undertaken. Maintenance and repair measures required based on inspection observations are also included in Appendix A.

Conditions that could eventually require maintenance but do not meet the criterion for repair (e.g., minor pavement cracking or deformation) were also noted by the field team so that these items can be rechecked during subsequent inspections.

3 Inspection Results

Cap conditions identified during the 2017 inspection meriting the Port's attention are shown on Map A-1 (Appendix A) and described in the following subsections. Appendix A lists items requiring maintenance based on the CIR (RETEC 2006), which includes the cap I&M plan referenced in this report. The complete text from Section 5 and Table 5-1 of the CIR is included in Appendix C.

During the 2017 inspection, most of the cap was observed to be free of damage that could impact its integrity. The general condition was largely unchanged since the previous (2016) inspection, with the exception of specific items requiring attention and described further in the following subsections.

3.1 SETTLEMENT

An area of settlement with a depth of approximately 4 to 6 in. was observed near a catch basin structure in grid E-20 (2017-014 on Map A-1). Cracking was observed around the catch basin structure and in the area of settlement.

An area of approximately 500 ft^2 of settlement greater than 3 in. and alligator cracking was observed in grid F-12 (2015-005 on Map A-1), south of the maintenance shop. The settlement and alligator cracking in this area were also observed and documented in the 2015 and 2016 inspections.

At both of these locations, the pavement and base course should be removed and replaced, as indicated in Section 5.2.2 of the CIR (RETEC 2006), during the upcoming dry season.

3.2 CRACKING

Cracks in asphalt pavement were observed in multiple grids, as noted in Appendix A. These areas typically contained alligator cracking that was associated with evolving surface damage (e.g., loss of small portions of the top lift of pavement within small areas circumscribed by cracks), or generally linear cracks with some alligator cracking nearby.

Cracks at construction pavement joints were observed throughout the cap. Most of these cracks were less than 1/8 in. wide and could extend hundreds of feet in length. These cracks do not require immediate repair but should be monitored during future inspections. Some of the cracks at construction joints were significantly wider than 1/8 in. and require repair; these cracks are detailed in Appendix A.

Divots in the pavement caused by landing gears (i.e., support stands of container trailers) and container corners were also observed throughout the cap. The divots did not penetrate the pavement and were typically less than 1/2 in. deep. These divots also

do not require immediate repair; however, they should be monitored to ensure that they do not cause settlement greater than 3 in. and do not expose the sub-base material.

Additional divots were observed in several locations and should be repaired:

- Divots were observed in an area of pavement damage approximately 12 × 6 ft in grid E-11 (2017-019 on Map A-1). A portion of the pavement has been saw cut but not yet repaired.
- Divots deeper than 3 in. were observed in an area approximately 60 ft in length in grid E-11 (2017-022 on Map A-1).
- Divots and pavement damage were observed in an area approximately 3 × 15 ft in grid E-11 (2017-023 on Map A-1). This area has been saw cut but not yet repaired. Alligator cracking was observed in the vicinity of this damage.
- Divots and pavement damage were observed in an area approximately 5 × 8 ft in grid E-11 (2017-024 on Map A-1). This area has been saw cut but not yet repaired.
- Divots were observed in grid D-3 (2017-029 on Map A-1). Additional cracking was observed in the vicinity of the damage.
- Divots first observed during the 2016 inspection were again noted during this inspection in grid E-11 (2016-011 on Map A-1). The divots extend over an area approximately 36 × 6 in. in size, and alligator cracking was observed in the vicinity of the divots.

3.3 DAMAGE

The following types of damage observed are listed with photographs in Appendix A:

- Hole in pavement (2017-006, grid F-2 on Map A-1)
- Damaged bollard (2013-001, grid E-20 on Map A-1)
- Small woody shrubs (butterfly bushes) taking root in pavement joints
- Broken pavement surrounding manhole and catch basin structures
- Alligator cracking (described in Section 3.2)

A hole approximately 3 × 3 ft was observed in the pavement in the cap area south of the secure yard in the vicinity of the south entrance (grid F-2 on Map A-1). The pavement in this area should be cleaned and patched.

A damaged bollard (a vertical barricade post painted yellow in grid E-20 near the north end of the scales at Gate 4), previously noted in the 2010–2016 inspections, was observed again in 2017. While a repair had been attempted in 2013 (based on 2012 inspection recommendations), the 2013 inspection observations noted that the bollard appeared to have been re-damaged by vehicles, causing a gap at the point where the structure penetrates the asphalt cap. Damage to this bollard appears to be a chronic issue.

Butterfly bushes were observed growing in joints in the pavement (Appendix A) predominantly in the north and south portions of the terminal. Although attempts to remove such vegetation from multiple locations occurred in 2015 and 2017, the stumps of these plants need to be removed and the asphalt patched. Furthermore, new plants were identified in the 2016 inspection that need to be removed and the pavement patched. Plants and stumps were observed in grids A-4, A-8, E-3, E-21, F-1, F-2, F-4, F-18, and F-19.

In grid F-10, a manhole with broken pavement around the perimeter was observed (2015-003 on Map A-1). This damage was originally identified in 2015 and should be repaired. A second manhole with broken pavement around the perimeter was observed in grid F-8 and should also be repaired (2016-012 on Map A-1); this damage was first observed during the 2016 inspection. Additional pavement damage was observed around catch basin structures in grids F-2, E-22, F-16, and F-14, and manhole structures in grids A-9, C-6, and E-12.

3.4 STANDING WATER

No standing water deeper than 3 in. was observed during the inspection. There was no measurable precipitation in the 10 days before this inspection.

One area of standing water deeper than 3 in. was noted during the 2015 inspection in grid F-12. The area was approximately 500 ft^2 and showed signs of settlement (described in Section 3.1). Settlement greater than 3 in. was observed in this area and in grid E-20 (2017-014 on Map A-1) during this inspection. Removal and replacement of the base course and pavement will repair the settlement and prevent future ponding in these areas.

3.5 REPAIR OF CONDITIONS NOTED IN PREVIOUS INSPECTIONS

Appendix B provides a list of repairs conducted in 2017 that were found to be in good condition during the 2017 inspection. Cracking around the rails in an area approximately 4 × 8 ft located in grid E-11 and first observed during the 2016 inspection was observed to be repaved during the 2017 inspection. A storm drain in grid F-2 observed to be blocked and covered with standing water during the 2016 inspection had been cleared for the 2017 inspection. A linear crack penetrating the cap in grid G-1, first observed during the 2015 inspection, had been sealed for the 2017 inspection.

3.6 INSPECTION OF STORMWATER UTILITY UPGRADES

SSA performed stormwater utility upgrade work at six locations within T-18 in 2016 and shown on Figure E-1 in last year's report (Windward 2017). Four of these locations were located either entirely or partially on the T-18 environmental cap, so work involved temporarily removing and subsequently replacing the pavement cap. The stormwater utility upgrade work locations within the cap boundary were inspected during the 2017 T-18 inspection; the pavement in all four locations was observed to be

in excellent condition. These areas are effectively restored and will no longer be individually inspected and described in future inspection reports unless new work is done.

4 Conclusions and Needed Repairs

Recommended repair and maintenance measures listed in Appendix A are discussed further in the following subsections. Repairs should be completed in accordance with the requirements and general procedures described in the CIR (RETEC 2006) (Appendix C). Where procedures are not described in sufficient detail, repairs and maintenance should be completed using the Port's standard materials and specifications.

4.1 SETTLEMENT

Two localized areas of settlement were observed during the 2017 inspection and are described in Section 3.1. The identified areas of settlement should be removed and replaced as described in Section 5.2.2 of the CIR (RETEC 2006).

4.2 CRACKING

Thirty-five localized areas of cracking were identified for repair, six of which were near rail lines. Most cracks had adjacent alligator cracking. These areas of cracking and the recommended repair methods are described in Appendix A.

The divots described in Section 3.2 should be repaired as described in Appendix A.

4.3 DAMAGE

The bollard in grid E-20 shows evidence of recurring damage that has caused a gap at the point where the structure penetrates the asphalt cap. This gap may allow water to infiltrate underlying soils. The bollard should be repaired by placing new asphalt around the base. Because repeated damage to this bollard has been observed, some sort of replacement/alternative protective structure (e.g., ecology block) should be considered.

Plant growth was observed in multiple locations throughout the cap. These plants should be removed, including the root structures and excess soil, and the areas should be patched with asphalt.

A number of pavement areas with alligator cracking and other surface damage were observed, including areas near catch basins and manhole structures. These areas should be repaired as described in Appendix A.

4.4 STANDING WATER

Standing water deeper than 3 in. was not observed during this inspection due to the lack of recent rain. The areas of localized settlement described in Section 3.1 should be repaired (i.e., remove the pavement and base course and replace the cap to grade) so as to prevent future ponding issues.

5 References

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Appendix A. Conditions Observed During 2017 Inspection Requiring Maintenance or Repair

Contents:

Table A1 includes locations of observations made during the 2017 inspection. Locations are identified by a seven-digit Map ID in the first column of the table. Specific details regarding each observation have been provided separately to the Port to help prioritize and implement corrective measures. Photos of each location are saved in the project file and are available upon request.

Table A1. Environmental cap observations

Map ID[a]	Grid Location	Required Maintenance Measures[b]	Easting[c]	Northing[c]
Cracks and Other Damage that Appear to Penetrate the Cap Cross Section				
2017-002	F-1	A	1266362	212443
2017-004	F-1	A	1266343	212459
2017-006	F-2	clean and patch	1266337	212545
2017-010	F-23	A	1266319	217859
2017-015	E-19	A	1266153	216949
2017-020	E-11	A	1266068	214881
2017-025	F-5	A	1266412	213386
2017-028	D-3	B	1265759	212791
2017-030	D-6	A	1265950	213570
2017-031	D-6	A	1265908	213562
2016-007	F-14	B	1266400	215600
2016-010	E-12	B	1266052	215007
Damage/Alligator Cracking Around Utility Access Points				
2017-003	F-1	A	1266356	212743
2017-005	F-2	A	1266338	212534
2017-011	E-22	B	1266169	217734
2017-016	F-16	A	1266318	216159
2017-034	C-6	B	1265551	213747
2017-036	A-9	remove and replace pavement, A	1265214	214349
2017-037	E-12	remove and replace pavement, A	1266167	215044
2016-002	F-24	B	1266388	218069
2016-006	F-14	B	1266370	215545
2016-012	F-8	B	1266402	214224
2016-016	F-2	A	1266280	212509
2015-003 (P15-12)	F-10	remove and replace pavement, A	1266413	215568
2013-001 (P13-11)	E-20 (damaged bollard)	repair bollard	1266131	217048
Settlement > 3 in. with Alligator Cracking				
2017-014	E-20	remove and replace pavement, A	1266119	217027
2015-005 (A15-8)	F-12	remove and replace pavement	1266418	215124
Alligator Cracking in the Vicinity of Linear Cracks				
2017-017	F-14	B	2166282	215746
2017-021	E-10	A	1266170	214513
2017-026	H-5	A	1266915	213271
2017-033	D-7	B	1265833	213907

Map ID[a]	Grid Location	Required Maintenance Measures[b]	Easting[c]	Northing[c]
Alligator Cracking				
2017-018	F-13	B	1266344	215432
2016-005	F-14	B	1266367	215576
2016-015	F-14	B	1266343	215698
2015-001 (A15-33)	F-13	B	1266336	215302
Linear Cracks Along Pavement Joints				
2017-012	E-22	A	1266153	217711
2016-013	C-7	A	1265656	213806
Divots and adjacent pavement damage				
2017-019	E-11	B	1266087	214761
2017-022	E-11	B	1266193	214903
2017-023	E-11	B	1266175	214816
2017-024	E-11	B	1266203	214806
2017-029	D-3	B	1265935	212863
2016-011	E-11	B	1266147	214818
2015-002 (L15-35)	G-8	B	1266526	214138
Other Surface Cracks				
2017-001	F-1	A	1266347	212310
2017-009	F-23	A	1266309	217946
2017-013	E-21	A	1266160	217482
2016-014	E-3	A	1266205	212946
2015-007 (L15-30)	G-1	A	1266496	212261
Vegetation Growth Through Pavement				
2017-007	F-2	C	1266319	212716
2017-008	F-2	C	1266378	212724
2017-027	E-3	C	1266126	212781
2017-032	A-4	C	1265067	213104
2017-035	A-8	C	1265007	214119
2016-003	F-19	C	1266263	216788
2016-004	F-19	C	1266238	216794
2015-006 (P15-10)	F-4	C	1266353	213017
2015-008 (P15-30)	F-1	C	1266422	212368
2015-009 (P15-31)	F-1	C	1266424	212357
2015-010 (P15-32)	F-1	C	1266457	212306
2015-011 (P15-33)	F-2	C	1266351	212566
2015-012 (P15-1)[d]	E-21	C	1266141	217287
2014-001 (P14-22)	F-18	C	1266250	216737
2014-002 (P14-19)	F-18	C	1266278	216734

[a] See Map A-1. The first four digits of the Map ID indicate the year in which the item was first observed. The Map ID in parentheses is the ID used in previous inspection reports (prior to the 2016 inspection report).

[b] Specific repair measures to be reviewed with Seaport maintenance staff. Measures are based on the cap I&M plan (RETEC 2006). A = clean and seal crack/joint; B = remove first lift of pavement, inspect for cracking on next lift, and repeat as necessary; replace lifts with tack coat and asphaltic concrete pavement; C = remove plants/roots and clean and patch penetrations.

[c] NAD83 State Plane Washington North coordinates – US Survey feet

[d] This location was identified as "2015-007 (P15-1)" in the 2016 inspection report (Windward 2017).

I&M – inspection and maintenance

ID – identification

NAD83 – North American Datum of 1983

Seaport – Seaport Environmental

Identified issue for recommended repair

Terminal 18 boundary

Inspection area boundary

TPH hotspot boundary

Elliott Bay

West Waterway

East Waterway

Intermodal Yard

See inset

North Entrance

South Entrance

2016-002
2017-009
2017-010
2017-012
2017-011
2017-013
2015-012
2013-001
2017-014
2017-015
2016-003
2016-004
2014-002
2014-001
2017-016
2017-017
2016-015
2016-007
2016-005
2016-006
2017-018
2015-001
2015-005
2017-037
2016-010
2017-022
2017-020
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2016-011
2017-024
2017-019
2015-003
2017-021
2017-036
2016-012
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2017-035
2017-033
2017-034
2016-013
2017-031
2017-030
2017-025
2017-026
2017-032

Inset

2015-006
2016-014
2017-029
2017-028
2017-027
2017-007
2017-008
2017-006
2015-011
2017-005
2016-016
2017-003
2017-004
2017-002
2015-008
2015-009
2017-001
2015-010
2015-007

0 100 200 Feet

0 50 100 Meters

0 250 500 Feet

0 100 200 Meters

N

Windward environmental LLC

Map A-1. Conditions observed during 2017 inspection requiring maintenance or repair

Prepared by craigh, 1/26/2018; W:\Projects\Hart Crowser-POS-LTC\Data\GIS\T-18\Cap Inspection 2017\6721_Cap inspection 2017.mxd

Aerial photo: USDA FSA NAIP DOQQ, 1 m resolution, August 2015.

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RETEC. 2006. Design set #2 capping implementation report. Terminal 18 expansion, Harbor Island Superfund Site, Seattle, Washington. Prepared for Port of Seattle and Harbor Island Steering Committee. The RETEC Group, Inc., Seattle, WA.

Windward. 2017. 2016 Terminal 18 cap inspection report, Port of Seattle Terminal 18, Harbor Island. Windward Environmental LLC, Seattle, WA.

Appendix B. Summary of T-18 Pavement Repairs Observed During 2017 Annual Cap Inspection

Contents:

Table B1. T-18 pavement repairs observed

ID[a]	Grid Location[b]	Condition	Identified Maintenance Condition from Cap I&M Plan	Observed Maintenance	Easting	Northing	Photo
2016-009	E-11	cracking around rails in area approximately 4 × 8 ft; damage surrounded by alligator cracking	surface cracking; surface damage	area repaved and edges of new pavement sealed	1266112	214934	
2016-016	F-2	partially blocked storm drain inlet (ponding)	standing water	debris cleared from catch basin inlet (see Appendix A)	1266280	212509	
2015-007 (L15-30)[c]	G-1	linear crack penetrating cap	surface cracking	most of crack has been sealed since last inspection (see Appendix A)	1266496	212261	

[a] The first four digits of the Map ID indicate the year in which the item was first observed. The Map ID in parentheses is the ID used in previous inspection reports (prior to the 2016 inspection report).

[b] The locations of these items are shown in Appendix A of the 2016 inspection report (Windward 2017).

[c] This location was identified as "2015-007 (P15-1)" in the 2016 inspection report (Windward 2017).

I&M – inspection and maintenance

ID – identification

T-18 – Terminal 18

REFERENCES

Windward. 2017. 2016 Terminal 18 cap inspection report, Port of Seattle Terminal 18, Harbor Island. Windward Environmental LLC, Seattle, WA.

APPENDIX C. CAP INSPECTION AND MAINTENANCE PLAN

Contents:

Section 5 and Table 5-1 from T-18 Expansion *Design Set #2 Capping Implementation Report*

5 Cap Inspection and Maintenance Plan

This plan details the inspection and maintenance (I&M) requirements for the caps (ACP, PCCP, landscape, railroad) on the Design Set 2 properties. The area covered by this I&M plan is shown on Figure 5-1. The purpose of this I&M plan is to ensure future maintenance of the cap in a manner that complies with all of the objectives of the cap as stated in the SOW (EPA, 1996c). The design components of the caps are described in Section 3 of this document.

5.1 Cap Inspection and Maintenance Requirements

I&M requirements for each cap type include cap inspections and cap maintenance based upon inspection results, each of which is discussed below.

Figure 5-1 shows the areas where the Port has responsibility for operation and maintenance of the cap. The City of Seattle will retain responsibility for maintenance of the cap over City streets.

5.1.1 Cap Inspections

The various caps will be visually inspected by the Port annually.

Surface conditions and conditions along structures are the two main components of the cap that will be visually inspected. The surface will be inspected for cracking, damage, settlement, and standing water. It will be assumed that if the top surface of the cap is in acceptable condition, then the underlying layers of pavement are also in acceptable condition. From these visual inspections, the integrity of the cap can be determined, and any areas where maintenance is required can be identified.

Cap inspections examine how various site activities affect the integrity of the cap. Inspected areas and associated information will be noted on the cap inspection log provided in Figure 5-2.

5.2 Cap Maintenance

The ROD requires that capped areas be maintained to prevent infiltration of rainwater and reduce contamination into the environment. It also requires that existing asphalt and concrete surfaces be repaired to prevent infiltration of rainwater. Based upon inspection results, any potential damage, settling, or separation will be evaluated to determine if the item can be addressed by performing maintenance or repair to the cap. The results of the inspection will be documented and a field sketch prepared identifying any areas of concern.

Table 5-1 presents the types of cap conditions that may develop over time and the maintenance or repair required.

Conditions that may develop include settlement of the cap, water ponding on the asphalt or ballasted surface, potholes that develop in the asphalt or ballast or erosion of the landscape topsoil, or any other damage noted by the Port.

5.2.1 Surface Patching

Areas of settlement less than 3-inches deep will be patched. Surface patching will include brushing the area clean and placing standard asphalt to restore the settled area back to original grade. Standard asphalt patching will be placed in accordance with current Washington State Department of Transportation (WSDOT) standard specifications.

5.2.2 Removal/Replacement of Subgrade and Asphalt

Areas with settlement greater than 3-inches deep over short distances will require removal/replacement of asphalt and base course. Removal/ replacement will include removing the existing ACP or PCCP layer and removing the base course to a depth of 7 inches below existing grade. Base course and ACP or PCCP will then be replaced to meet original contract specifications.

Asphalt repair will be performed by identifying the extent of the failed area. The asphalt will be saw-cut 2 feet beyond the failed area perimeter and the full depth of asphalt and base course will be removed. The subgrade will be inspected by proof rolling for deflection and recompacted and/or replaced if necessary. The existing edges will be cleaned and tacking agent applied.

Crushed Stone Base Coarse (CSBC) will be placed and compacted with a mechanical hand tamper, as necessary. Existing CSBC may provide a suitable base course. WSDOT Class B ACP will be placed in a minimum 3-inch lift to match the thickness of the surrounding pavement and will be compacted in accordance with current WSDOT specifications. PCCP will be placed in a minimum 3-inch lift.

5.2.3 Replacement of Railroad Ballast or Subballast

Areas with settlement greater than 3 inches deep will require replacement of subballast and/or ballast to achieve the full depth as described in Section 3.3.3 of this document. Repair will be performed and materials supplied in accordance with the contract specifications.

5.2.4 Replacement of Topsoil

Areas with settlement greater than 3 inches deep will require replacement of topsoil to achieve the full depth as described in Section 3.3.4 of this document. Repair will be performed and materials supplied in accordance with the contract specifications.

5.3 Health and Safety Requirements

Health and safety requirements during routine inspections will consist of appropriate PPE to work in an active terminal facility. Required PPE consists of a hard hat, safety glasses, steel-toe boots, and a reflective vest.

Workers involved in repair or replacement of pavement that is completed within the cap thickness itself do not require 40-hour training, but must adhere to the WISHA general construction safety standards. Level D personal protective equipment should be suitable for most cap I&M activities.

In the event that maintenance work is required below the limits of the cap or below the landscape identifier layer, the contractor performing the work must provide 40-hour trained workers and a Health and Safety Plan.

5.4 Documentation and Reporting

The Port will document cap conditions and relevant observations noted during each inspection. At a minimum, each inspection event will require that a log be completed (Figure 5-2). Reports documenting cap inspections, maintenance, and repair will be submitted to EPA annually. Annual reports will consist of inspection forms and any documentation of maintenance and/or repair.

Cap repair or maintenance reports based on a specific inspection event will be filed together as a packet with the inspection forms themselves. Documentation regarding all cap inspections and cap maintenance activities performed will be maintained by the Port of Seattle.

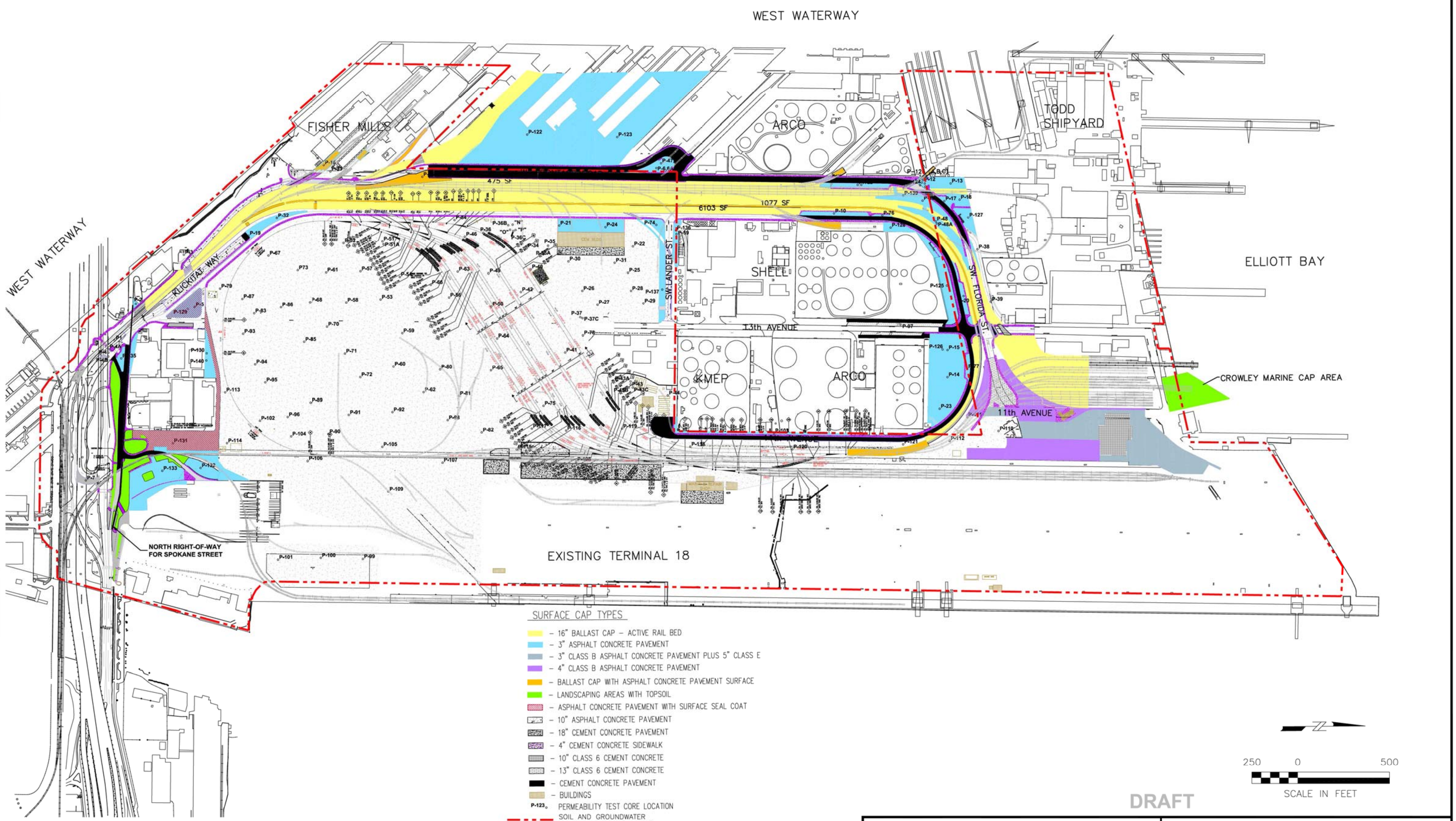
Table 5-1 Maintenance Required Based On CAP Inspections

Inspection Item	CAP Condition	Maintenance Required
ACP Pavement Surface	Surface cracking	Repair cracks
	Surface settlement < 3 inches deep	Surface patching
	Surface settlement over short distances > 3 inches deep	Repair by removing ACP, recompacting and regrading the subgrade.
PCCP Pavement Surface	Surface cracking	Repair cracks
	Surface settlement < 3 inches deep	Surface patching
	Surface settlement over short distances > 3 inches deep	Repair by removing PCCP, recompacting and regrading the subgrade.
Ballast	Surface settlement / erosion	Replace ballast to full 16-inch depth
Topsoil	Surface settlement / erosion	Replace topsoil to full 12-inch depth.

APPENDIX D. SURFACE CAP MATERIALS OF CONSTRUCTION

Contents:

Figure 3-1 from T-18 Expansion *Design Set #2 Capping Implementation Report*



RETEC

T18 EXPANSION - DESIGN SET #2 CAPPING IMPLEMENTATION REPORT HARBOR ISLAND S&GOU SUPERFUND SITE. SEATTLE, WA. HISGS-04294-300	SURFACE CAP MATERIALS OF CONSTRUCTION
DATE: 02/08/06 DRWN: A.S./SEA	FIGURE 3-1

APPENDIX E. 2017 TERMINAL 18 SOIL AND GROUNDWATER DATA FROM SELECT NEAR-OUTFALL LOCATIONS

20 YEARS FLOYD | SNIDER
strategy ▪ science ▪ engineering

Two Union Square
601 Union Street, Suite 600
Seattle, WA 98101
tel: 206.292.2078 fax: 206.682.7867

Memorandum

To: Brick Spangler, Port of Seattle

Copies: Warren Hansen, Windward Environmental, LLC

From: Stephen Bentsen, PE, and Layni Wachter, Floyd|Snider

Date: March 5, 2018

Project No: POS-SD-04.03000

Re: **2017 Terminal 18 Soil and Groundwater Data from Select Near-Outfall Locations**

The Port of Seattle (Port), in cooperation with SSA Terminals (SSAT), is currently planning for eventual repair of stormwater outfall pipes at Terminal 18. The repair of these outfalls is a priority for the Port and is necessary to maintain the structural integrity of the stormwater system that serves the approximately 200-acre marine cargo terminal. It is not known if excavation will be required, as some or all of the outfall pipes may be repairable using non-intrusive means. As part of the design process, Floyd|Snider and Hart Crowser obtained soil and groundwater samples from the vicinity of each of the 12 outfalls to evaluate dewatering water and excavated material management needs in each work area. Soil samples were obtained in accordance with the Hart Crowser Sampling and Analysis Plan/Quality Assurance Project Plan (SAP/QAPP; Hart Crowser 2017). Groundwater samples were obtained in accordance with Floyd|Snider's SAP/QAPP (Floyd|Snider 2017).

In June 2017, monitoring wells were installed adjacent to each of the 12 outfall locations with the specific purpose of collecting analytical data for the Construction Stormwater General Permit and soil disposal characterization. Composite soil samples were collected during the installation of the wells and analyzed for metals, polychlorinated biphenyls (PCBs), total petroleum hydrocarbons (TPH), and volatile organic compounds (VOCs). In December 2017, groundwater samples were collected from each monitoring well and analyzed for metals, PCBs and TPH. The soil and groundwater analytical results are shown in Tables 1 and 2, respectively. The wells at which the soil and groundwater samples were obtained are shown on Figures 1a and 1b.

REFERENCES

Floyd|Snider. 2017. *Service Directive 04, Sampling and Analysis Plan/Quality Assurance Project Plan*. Prepared for the Port of Seattle. December.

Hart Crowser. 2017. *Sampling and Analysis Plan, Proposed Outfall Repairs, SSA Marine Terminal 18, Port of Seattle, Seattle, Washington.* Prepared for the Port of Seattle. 6 June.

LIST OF ATTACHMENTS

Table 1 Summary of Composite Soil Analytical Results

Table 2 Summary of Groundwater Analytical Results

Figure 1a Potential Outfall Repair Location Monitoring Wells, North Portion

Figure 1b Potential Outfall Repair Location Monitoring Wells, South Portion

Tables

Table 1
Summary of Composite Soil Analytical Results

	Location[1]	Subbasin 7 HC-O7	Subbasin 8 HC-O8	Subbasin 9 HC-O9	Subbasin 11 HC-O11	Subbasin 13 HC-O13	Subbasin 14 HC-O14	Subbasin 15 HC-O15	Subbasin 16 HC-O16	Subbasin 17 HC-O17	Subbasin 18 HC-O18	Subbasin 19 HC-O19	Subbasin 20 HC-O20
	Sample ID	HC-O7	HC-O8	HC-O9	HC-O11	HC-O13	HC-O14	HC-O15	HC-O16	HC-O17	HC-O18	HC-O19	HC-O20
	Sample Date	06/13/2017	06/13/2017	06/19/2017	06/28/2017	6/27/2017	06/27/2017	06/16/2017	06/14/2017	06/14/2017	06/12/2017	06/15/2017	06/15/2017
Analyte	**Units**												
Metals by USEPA 6010C & 7471B													
Arsenic	mg/kg				12 U	14 U	14 U						
Barium	mg/kg				38	49	35						
Cadmium	mg/kg				0.61 U	0.69 U	0.72 U						
Chromium	mg/kg				24	51	25						
Lead	mg/kg				18	25	10						
Mercury	mg/kg				0.31 U	0.34 U	0.36 U						
Selenium	mg/kg				12 U	14 U	14 U						
Silver	mg/kg				1.2 U	1.4 U	1.4 U						
TCLP Metals by USEPA 6010C & &7470B													
Arsenic	mg/L	0.4 U	0.4 U	0.4 U				0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
Barium	mg/L	0.2 U	0.33	0.2 U				0.2 U	0.21	0.2 U	0.2 U	0.2 U	0.43
Cadmium	mg/L	0.02 U	0.02 U	0.02 U				0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Chromium	mg/L	0.02 U	0.02 U	0.02 U				0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Lead	mg/L	0.2 U	0.2 U	0.2 U				0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Mercury	mg/L	0.005 U	0.005 U	0.005 U				0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
Selenium	mg/L	0.4 U	0.4 U	0.4 U				0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
Silver	mg/L	0.04 U	0.04 U	0.04 U				0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
Polychlorinated Biphenyls (PCBs) by USEPA 8082A													
PCB Aroclor 1016	mg/kg	0.06 U	0.061 U	0.065 U	0.061 U	0.069 U	0.072 U	0.067 U	0.06 U	0.061 U	0.064 U	0.062 U	0.061 U
PCB Aroclor 1221	mg/kg	0.06 U	0.061 U	0.065 U	0.061 U	0.069 U	0.072 U	0.067 U	0.06 U	0.061 U	0.064 U	0.062 U	0.061 U
PCB Aroclor 1232	mg/kg	0.06 U	0.061 U	0.065 U	0.061 U	0.069 U	0.072 U	0.067 U	0.06 U	0.061 U	0.064 U	0.062 U	0.061 U
PCB Aroclor 1242	mg/kg	0.06 U	0.061 U	0.065 U	0.061 U	0.069 U	0.072 U	0.067 U	0.06 U	0.061 U	0.064 U	0.062 U	0.061 U
PCB Aroclor 1248	mg/kg	0.06 U	0.061 U	0.065 U	0.061 U	0.069 U	0.072 U	0.067 U	0.06 U	0.061 U	0.064 U	0.062 U	0.061 U
PCB Aroclor 1254	mg/kg	0.06 U	0.061 U	0.065 U	0.061 U	0.069 U	0.072 U	0.067 U	0.06 U	0.061 U	0.064 U	0.062 U	0.061 U
PCB Aroclor 1260	mg/kg	0.11	0.061 U	0.36	0.061 U	0.069 U	0.072 U	0.067 U	0.06 U	0.061 U	0.064 U	0.062 U	0.061 U
PCBs (Total, Aroclors)	mg/kg	0.11	0.061 U	0.36	0.061 U	0.069 U	0.072 U	0.067 U	0.06 U	0.061 U	0.064 U	0.062 U	0.061 U
Total Petroleum Hydrocarbons by NWTPH-Gx/Dx													
Gasoline-Range Organics	mg/kg	12 U	6.7 U	7.8 U	9.8 U	2,500 [2]	11 U	8.2 U	5.8 U	770 [3]	7.2 U	7.1 U	6.8 U
Diesel-Range Organics	mg/kg	41 U	30 U	100	310 U	8,800	42 [4]	140	330	2,300	32 U	31 U	30 U
Oil-Range Organics	mg/kg	140	160	180	4,500	1,500 [5]	180	300	210	740	68	62 U	80
Volatile Organic Compounds by USEPA 8260C													
1,1,1,2-Tetrachloroethane	mg/kg	0.001 U	0.0011 U	0.0012 U	0.00096 U	0.81 U	0.0015 U	0.0014 U	0.06 U	0.065 U	0.001 U	0.0012 U	0.0011 U
1,1,1-Trichloroethane	mg/kg	0.001 U	0.0011 U	0.0012 U	0.00096 U	0.81 U	0.0015 U	0.0014 U	0.06 U	0.065 U	0.001 U	0.0012 U	0.0011 U
1,1,2,2-Tetrachloroethane	mg/kg	0.001 U	0.0011 U	0.0012 U	0.00096 U	0.81 U	0.0015 U	0.0014 U	0.06 U	0.065 U	0.001 U	0.0012 U	0.0011 U
1,1,2-Trichloroethane	mg/kg	0.001 U	0.0011 U	0.0012 U	0.00096 U	0.81 U	0.0015 U	0.0014 U	0.06 U	0.065 U	0.001 U	0.0012 U	0.0011 U
1,1-Dichloroethane	mg/kg	0.001 U	0.0011 U	0.0012 U	0.00096 U	0.81 U	0.0015 U	0.0014 U	0.06 U	0.065 U	0.001 U	0.0012 U	0.0011 U

Table 1
Summary of Composite Soil Analytical Results

	Location[1]	Subbasin 7 HC-O7	Subbasin 8 HC-O8	Subbasin 9 HC-O9	Subbasin 11 HC-O11	Subbasin 13 HC-O13	Subbasin 14 HC-O14	Subbasin 15 HC-O15	Subbasin 16 HC-O16	Subbasin 17 HC-O17	Subbasin 18 HC-O18	Subbasin 19 HC-O19	Subbasin 20 HC-O20
	Sample ID	HC-O7	HC-O8	HC-O9	HC-O11	HC-O13	HC-O14	HC-O15	HC-O16	HC-O17	HC-O18	HC-O19	HC-O20
	Sample Date	06/13/2017	06/13/2017	06/19/2017	06/28/2017	6/27/2017	06/27/2017	06/16/2017	06/14/2017	06/14/2017	06/12/2017	06/15/2017	06/15/2017
Analyte	**Units**												
Volatile Organic Compounds by USEPA 8260C (cont.)													
1,1-Dichloroethene	mg/kg	0.001 U	0.0011 U	0.0012 U	0.00096 U	0.81 U	0.0015 U	0.0014 U	0.06 U	0.065 U	0.001 U	0.0012 U	0.0011 U
1,1-Dichloropropene	mg/kg	0.001 U	0.0011 U	0.0012 U	0.00096 U	0.81 U	0.0015 U	0.0014 U	0.06 U	0.065 U	0.001 U	0.0012 U	0.0011 U
1,2,3-Trichlorobenzene	mg/kg	0.001 U	0.0011 U	0.0012 U	0.00096 U	0.81 U	0.0015 U	0.0014 U	0.06 U	0.065 U	0.001 U	0.0012 U	0.0011 U
1,2,3-Trichloropropane	mg/kg	0.001 U	0.0011 U	0.0012 U	0.00096 U	0.81 U	0.0015 U	0.0014 U	0.06 U	0.065 U	0.001 U	0.0012 U	0.0011 U
1,2,4-Trichlorobenzene	mg/kg	0.001 U	0.0011 U	0.0012 U	0.00096 U	0.81 U	0.0015 U	0.0014 U	0.06 U	0.065 U	0.001 U	0.0012 U	0.0011 U
1,2,4-Trimethylbenzene	mg/kg	0.001 U	0.0011 U	0.0012 U	0.00096 U	5.5	0.0015 U	0.002	0.083	0.42	0.001 U	0.0012 U	0.0028
1,2-Dibromo-3-chloropropane	mg/kg	0.0051 U	0.0055 U	0.006 U	0.0048 U	4 U	0.0077 U	0.0069 U	0.3 U	0.32 U	0.0051 U	0.0059 U	0.0054 U
1,2-Dibromoethane	mg/kg	0.001 U	0.0011 U	0.0012 U	0.00096 U	0.81 U	0.0015 U	0.0014 U	0.06 U	0.065 U	0.001 U	0.0012 U	0.0011 U
1,2-Dichlorobenzene	mg/kg	0.001 U	0.0011 U	0.0012 U	0.00096 U	0.81 U	0.0015 U	0.0014 U	0.06 U	0.065 U	0.001 U	0.0012 U	0.0011 U
1,2-Dichloroethane	mg/kg	0.001 U	0.0011 U	0.0012 U	0.00096 U	0.81 U	0.0015 U	0.0014 U	0.06 U	0.065 U	0.001 U	0.0012 U	0.0011 U
1,2-Dichloropropane	mg/kg	0.001 U	0.0011 U	0.0012 U	0.00096 U	0.81 U	0.0015 U	0.0014 U	0.06 U	0.065 U	0.001 U	0.0012 U	0.0011 U
1,3,5-Trimethylbenzene	mg/kg	0.001 U	0.0011 U	0.0012 U	0.00096 U	2.2	0.0015 U	0.0014 U	0.06 U	0.21	0.001 U	0.0012 U	0.0014
1,3-Dichlorobenzene	mg/kg	0.001 U	0.0011 U	0.0012 U	0.00096 U	0.81 U	0.0015 U	0.0014 U	0.06 U	0.065 U	0.001 U	0.0012 U	0.0011 U
1,3-Dichloropropane	mg/kg	0.001 U	0.0011 U	0.0012 U	0.00096 U	0.81 U	0.0015 U	0.0014 U	0.06 U	0.065 U	0.001 U	0.0012 U	0.0011 U
1,4-Dichlorobenzene	mg/kg	0.001 U	0.0011 U	0.0012 U	0.00096 U	0.81 U	0.0015 U	0.0014 U	0.06 U	0.065 U	0.001 U	0.0012 U	0.0011 U
2,2-Dichloropropane	mg/kg	0.001 U	0.0011 U	0.0012 U	0.00096 U	0.81 U	0.0015 U	0.0014 U	0.06 U	0.065 U	0.001 U	0.0012 U	0.0011 U
2-Chloroethyl vinyl ether	mg/kg	0.0078 U	0.0085 U	0.006 U	0.0048 U	4 U	0.0077 U	0.011 U	0.46 U	0.5 U	0.0079 U	0.0059 U	0.0084 U
2-Chlorotoluene	mg/kg	0.001 U	0.0011 U	0.0012 U	0.00096 U	0.81 U	0.0015 U	0.0014 U	0.06 U	0.065 U	0.001 U	0.0012 U	0.0011 U
2-Hexanone	mg/kg	0.0051 U	0.0055 U	0.006 U	0.0048 U	4 U	0.0077 U	0.0069 U	0.3 U	0.32 U	0.0051 U	0.0059 U	0.0054 U
4-Chlorotoluene	mg/kg	0.001 U	0.0011 U	0.0012 U	0.00096 U	0.81 U	0.0015 U	0.0014 U	0.06 U	0.065 U	0.001 U	0.0012 U	0.0011 U
Acetone	mg/kg	0.022	0.012	0.055	0.031	8.1 U	0.048	0.026	0.6 U	0.65 U	0.014	0.012 U	0.023
Benzene	mg/kg	0.001 U	0.0011 U	0.0012 U	0.00096 U	0.81 U	0.0015 U	0.0014 U	0.06 U	0.065 U	0.001 U	0.0012 U	0.0011 U
Bromobenzene	mg/kg	0.001 U	0.0011 U	0.0012 U	0.00096 U	0.81 U	0.0015 U	0.0014 U	0.06 U	0.065 U	0.001 U	0.0012 U	0.0011 U
Bromochloromethane	mg/kg	0.001 U	0.0011 U	0.0012 U	0.00096 U	0.81 U	0.0015 U	0.0014 U	0.06 U	0.065 U	0.001 U	0.0012 U	0.0011 U
Bromodichloromethane	mg/kg	0.001 U	0.0011 U	0.0012 U	0.00096 U	0.81 U	0.0015 U	0.0014 U	0.06 U	0.065 U	0.001 U	0.0012 U	0.0011 U
Bromoform	mg/kg	0.0051 U	0.0055 U	0.006 U	0.0048 U	4 U	0.0077 U	0.0069 U	0.3 U	0.32 U	0.0051 U	0.0059 U	0.0054 U
Bromomethane	mg/kg	0.001 U	0.0011 U	0.0012 U	0.00096 U	0.81 U	0.0015 U	0.0014 U	0.06 U	0.065 U	0.001 U	0.0012 U	0.0011 U
Carbon disulfide	mg/kg	0.0037 J	0.0033 J	0.0052 J	0.012 J	1.2 U	0.027 J	0.0059 J	0.096 U	0.1 U	0.0049 J	0.0021 U	0.0048 J
Carbon tetrachloride	mg/kg	0.001 U	0.0011 U	0.0012 U	0.00096 U	0.81 U	0.0015 U	0.0014 U	0.06 U	0.065 U	0.001 U	0.0012 U	0.0011 U
Chlorobenzene	mg/kg	0.001 U	0.0011 U	0.0012 U	0.00096 U	0.81 U	0.0015 U	0.0014 U	0.06 U	0.065 U	0.001 U	0.0012 U	0.0011 U
Chloroethane	mg/kg	0.0051 U	0.0055 U	0.006 U	0.0048 U	4 U	0.0077 U	0.0069 U	0.3 U	0.32 U	0.0051 U	0.0059 U	0.0054 U
Chloroform	mg/kg	0.001 U	0.0011 U	0.0012 U	0.00096 U	0.81 U	0.0015 U	0.0014 U	0.06 U	0.065 U	0.001 U	0.0012 U	0.0011 U
Chloromethane	mg/kg	0.0051 U	0.0055 U	0.006 U	0.0048 U	4 U	0.0077 U	0.0069 U	0.3 U	0.32 U	0.0051 U	0.0059 U	0.0054 U
cis-1,2-Dichloroethene	mg/kg	0.001 U	0.0011 U	0.0012 U	0.00096 U	0.81 U	0.0015 U	0.0014 U	0.06 U	0.065 U	0.001 U	0.0012 U	0.0011 U
cis-1,3-Dichloropropene	mg/kg	0.001 U	0.0011 U	0.0012 U	0.00096 U	0.81 U	0.0015 U	0.0014 U	0.06 U	0.065 U	0.001 U	0.0012 U	0.0011 U
Cymene	mg/kg	0.001 U	0.0011 U	0.0012 U	0.00096 U	0.97	0.0015 U	0.0014 U	0.06 U	0.14 J	0.001 U	0.0032	0.0011 U

Table 1
Summary of Composite Soil Analytical Results

		Subbasin 7	Subbasin 8	Subbasin 9	Subbasin 11	Subbasin 13	Subbasin 14	Subbasin 15	Subbasin 16	Subbasin 17	Subbasin 18	Subbasin 19	Subbasin 20
Location[1]		HC-O7	HC-O8	HC-O9	HC-O11	HC-O13	HC-O14	HC-O15	HC-O16	HC-O17	HC-O18	HC-O19	HC-O20
Sample ID		HC-O7	HC-O8	HC-O9	HC-O11	HC-O13	HC-O14	HC-O15	HC-O16	HC-O17	HC-O18	HC-O19	HC-O20
Sample Date		06/13/2017	06/13/2017	06/19/2017	06/28/2017	6/27/2017	06/27/2017	06/16/2017	06/14/2017	06/14/2017	06/12/2017	06/15/2017	06/15/2017
Analyte	**Units**												
Volatile Organic Compounds by USEPA 8260C (cont.)													
Dibromochloromethane	mg/kg	0.001 U	0.0011 U	0.0012 U	0.00096 U	0.81 U	0.0015 U	0.0014 U	0.06 U	0.065 U	0.001 U	0.0012 U	0.0011 U
Dibromomethane	mg/kg	0.001 U	0.0011 U	0.0012 U	0.00096 U	0.81 U	0.0015 U	0.0014 U	0.06 U	0.065 U	0.001 U	0.0012 U	0.0011 U
Dichlorodifluoromethane	mg/kg	0.001 U	0.0011 U	0.0012 U	0.00096 U	1 U	0.0015 U	0.0014 U	0.06 U	0.065 U	0.001 U	0.0012 U	0.0011 U
Ethylbenzene	mg/kg	0.001 U	0.0011 U	0.0012 U	0.00096 U	2.8	0.0015 U	0.0014 U	0.06 U	0.065 U	0.001 U	0.0012 U	0.0011 U
Hexachlorobutadiene	mg/kg	0.0051 U	0.0055 U	0.006 U	0.0048 U	4 U	0.0077 U	0.0069 U	0.3 U	0.32 U	0.0051 U	0.0059 U	0.0054 U
Iodomethane	mg/kg	0.0074 U	0.008 U	0.0088 U	0.0065 U	5.9 U	0.01 U	0.01 U	0.44 U	0.48 U	0.0075 U	0.0087 U	0.0081 U
iso-Propylbenzene	mg/kg	0.001 U	0.0011 U	0.0012 U	0.00096 U	1.3	0.0015 U	0.0014 U	0.06 U	0.065 U	0.001 U	0.0012 U	0.0011 U
Methyl ethyl ketone	mg/kg	0.0066 U	0.0071 U	0.006 U	0.0048 U	4 U	0.0077 U	0.0069 U	0.3 U	0.32 U	0.0066 U	0.0059 U	0.0054 U
Methyl iso butyl ketone	mg/kg	0.0064 U	0.0069 U	0.006 U	0.0048 U	4 U	0.0077 U	0.0069 U	0.3 U	0.32 U	0.0064 U	0.0059 U	0.0054 U
Methylene chloride	mg/kg	0.01 U	0.011 U	0.006 U	0.0096 U	9.9	0.015 U	0.014 U	0.6 U	0.65 U	0.01 U	0.012 U	0.011 U
Methyl-Tert-Butyl Ether	mg/kg	0.001 U	0.0011 U	0.0012 U	0.00096 U	0.81 U	0.0015 U	0.0014 U	0.06 U	0.065 U	0.001 U	0.0012 U	0.0011 U
Naphthalene	mg/kg	0.001 U	0.0011 U	0.0012 U	0.0021	550	0.0015 U	1.9	5.9	230	0.001 U	0.017	0.2
n-Butylbenzene	mg/kg	0.001 U	0.0011 U	0.0012 U	0.00096 U	0.81 U	0.0015 U	0.0014 U	0.06 U	0.065 U	0.001 U	0.0012 U	0.0011 U
n-Propylbenzene	mg/kg	0.001 U	0.0011 U	0.0012 U	0.00096 U	0.88	0.0015 U	0.0014 U	0.06 U	0.065 U	0.001 U	0.0012 U	0.0011 U
sec-Butylbenzene	mg/kg	0.001 U	0.0011 U	0.0012 U	0.00096 U	0.81 U	0.0015 U	0.0014 U	0.06 U	0.065 U	0.001 U	0.0012 U	0.0011 U
Styrene	mg/kg	0.001 U	0.0011 U	0.0012 U	0.00096 U	0.81 U	0.0015 U	0.0014 U	0.06 U	0.065 U	0.001 U	0.0012 U	0.0011 U
tert-Butylbenzene	mg/kg	0.001 U	0.0011 U	0.0012 U	0.00096 U	0.81 U	0.0015 U	0.0014 U	0.06 U	0.065 U	0.001 U	0.0012 U	0.0011 U
Tetrachloroethene	mg/kg	0.001 U	0.0011 U	0.0012 U	0.00096 U	0.81 U	0.0015 U	0.0014 U	0.06 U	0.065 U	0.001 U	0.0012 U	0.0011 U
Toluene	mg/kg	0.0051 U	0.0055 U	0.006 U	0.0048 U	4 U	0.0077 U	0.0069 U	0.3 U	0.32 U	0.0051 U	0.0059 U	0.0054 U
trans-1,2-Dichloroethene	mg/kg	0.001 U	0.0011 U	0.0012 U	0.00096 U	0.81 U	0.0015 U	0.0014 U	0.06 U	0.065 U	0.001 U	0.0012 U	0.0011 U
trans-1,3-Dichloropropene	mg/kg	0.001 U	0.0011 U	0.0012 U	0.00096 U	0.81 U	0.0015 U	0.0014 U	0.06 U	0.065 U	0.001 U	0.0012 U	0.0011 U
Trichloroethene	mg/kg	0.001 U	0.0011 U	0.0012 U	0.00096 U	0.81 U	0.0015 U	0.0014 U	0.06 U	0.065 U	0.001 U	0.0012 U	0.0011 U
Trichlorofluoromethane	mg/kg	0.001 U	0.0011 U	0.0012 U	0.00096 U	0.81 U	0.0015 U	0.0014 U	0.06 U	0.065 U	0.001 U	0.0012 U	0.0011 U
Vinyl acetate	mg/kg	0.007 U	0.0076 U	0.0079 U	0.0048 U	4 U	0.0077 U	0.0089 U	0.39 U	0.42 U	0.0071 U	0.0078 U	0.0071 U
Vinyl chloride	mg/kg	0.001 U	0.0011 U	0.0012 U	0.00096 U	0.81 U	0.0015 U	0.0014 U	0.06 U	0.065 U	0.001 U	0.0012 U	0.0011 U
Xylene (meta & para)	mg/kg	0.002 U	0.0022 U	0.0024 U	0.0019 U	4.5	0.0031 U	0.0028 U	0.12 U	0.13 U	0.002 U	0.0023 U	0.0022 U
Xylene (ortho)	mg/kg	0.001 U	0.0011 U	0.0012 U	0.00096 U	1.9	0.0015 U	0.0014 U	0.06 U	0.065 U	0.001 U	0.0012 U	0.0011 U

Notes:

1 One composite sample was collected from each monitoring well boring location.
2 Per the laboratory, hydrocarbons indicative of heavier fuels are present in the sample and are impacting the gasoline result.
3 Per the laboratory, result is attributed to a single peak of naphthalene.
4 Per the laboratory, hydrocarbons in the oil range are impacting the diesel-range result.
5 Per the laboratory, hydrocarbons in the diesel range are impacting the lube oil-range result.

Abbreviations:

mg/L Milligrams per liter
TCLP Toxicity characteristic leaching procedure

Qualifiers:

J Analyte was detected, concentration is considered an estimate.
U Analyte was not detected at the given reporting limit.

Table 2
Summary of Groundwater Analytical Results

Location		Subbasin 7 HC-O7	Subbasin 8 HC-O8	Subbasin 9 HC-O9	Subbasin 11 HC-O11	Subbasin 13 HC-O13	Subbasin 14 HC-O14	Subbasin 15 HC-O15	Subbasin 16 HC-O16	Subbasin 17 HC-O17	Subbasin 17 HC-O17 Dup	Subbasin 18 HC-O18	Subbasin 19 HC-O19	Subbasin 20 HC-O20
Sample ID		HC-O7-12142017	HC-O8-12142017	HC-O9-12142017	HC-O11-12142017	HC-O13-12142017	HC-O14-12142017	HC-O15-12142017	HC-O16-12132017	HC-O17-12132017	HC-O67-12132017	HC-O18-12132017	HC-O19-12132017	HC-O20-12132017
Sample Date		12/14/2017	12/14/2017	12/14/2017	12/14/2017	12/14/2017	12/14/2017	12/14/2017	12/13/2017	12/13/2017	12/13/2017	12/13/2017	12/13/2017	12/13/2017
Analytes	**Units**													
Conventionals by SM 2540 D														
Total Suspended Solids	mg/L	29	24	16	19	16	18	24	30	29	29	30	26	20
Metals by USEPA 200.8 & 7470A														
Arsenic	µg/L	22 U	22 U	22 U	22 U	22 U	22 U	22 U	22 U	22 U	22 U	22 U	22 U	22 U
Barium	µg/L	110	29	30	80	60	77	140	60	79	83	52	30	34
Cadmium	µg/L	5.6 U	5.6 U	5.6 U	5.6 U	5.6 U	5.6 U	5.6 U	5.6 U	5.6 U	5.6 U	5.6 U	5.6 U	5.6 U
Chromium	µg/L	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U
Lead	µg/L	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U
Mercury	µg/L	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U
Selenium	µg/L	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U	11 U
Silver	µg/L	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U
Polychlorinated Biphenyls (PCBs) by USEPA 8082A														
PCB Aroclor 1016	µg/L	0.019 U	0.023 U	0.023 U	0.023 U	0.022 U	0.022 U	0.024 U	0.019 U	0.021 U	0.021 U	0.021 U	0.02 U	0.022 U
PCB Aroclor 1221	µg/L	0.019 U	0.023 U	0.023 U	0.023 U	0.022 U	0.022 U	0.024 U	0.019 U	0.021 U	0.021 U	0.021 U	0.02 U	0.022 U
PCB Aroclor 1232	µg/L	0.019 U	0.023 U	0.023 U	0.023 U	0.022 U	0.022 U	0.024 U	0.019 U	0.021 U	0.021 U	0.021 U	0.02 U	0.022 U
PCB Aroclor 1242	µg/L	0.019 U	0.023 U	0.023 U	0.023 U	0.022 U	0.022 U	0.024 U	0.019 U	0.021 U	0.021 U	0.021 U	0.02 U	0.022 U
PCB Aroclor 1248	µg/L	0.019 U	0.023 U	0.023 U	0.023 U	0.022 U	0.022 U	0.024 U	0.019 U	0.021 U	0.021 U	0.021 U	0.02 U	0.022 U
PCB Aroclor 1254	µg/L	0.019 U	0.023 U	0.023 U	0.023 U	0.022 U	0.022 U	0.024 U	0.019 U	0.021 U	0.021 U	0.021 U	0.02 U	0.022 U
PCB Aroclor 1260	µg/L	0.019 U	0.023 U	0.023 U	0.023 U	0.022 U	0.022 U	0.024 U	0.019 U	0.021 U	0.021 U	0.021 U	0.02 U	0.022 U
PCBs (Total, Aroclors)	µg/L	0.019 U	0.023 U	0.023 U	0.023 U	0.022 U	0.022 U	0.024 U	0.019 U	0.021 U	0.021 U	0.021 U	0.02 U	0.022 U
Total Petroleum Hydrocarbons (TPHs) by NWTPH-Gx/Dx														
Gasoline-Range Organics	µg/L	100 U	100 U	100 U	100 U	660	100 J[1]	150 J[1]	100 U	970 J[1]	970 J[1]	100 U	100 U	100 U
Diesel-Range Organics	µg/L	110	100 U	120	1,100	4,100	860	600	100 U	1,300	1,400	100 U	100 U	100 U
Oil Range-Organics	µg/L	250 U	250 U	250 U	390 U	1,500 U	310 U	250 U	250 U	250 U	250 U	250 U	250 U	250 U

Note:

1 The laboratory noted that the result is mainly attributed to a single peak of naphthalene.

Abbreviations:

µg/L Micrograms per liter
mg/L Milligrams per liter

Qualifiers:

J Analyte was detected; concentration is considered to be an estimate.
U Analyte was not detected; concentration given is the reporting limit.

Figures

Legend

- Monitoring Well[1]
- Outfalls to be Repaired
- 6 Sub-Basin ID
- Drainage Sub-Basin Boundary

Elliott Bay

East Waterway

Outfall 7
HC-O7
7
HC-O8
Outfall 8
8
6
HC-O9
Outfall 9
9
Crane Shop
North
HC-O11
Outfall 11
10
11
HC-O13
Outfall 13
13
MATCH LINE
Outfall 14
HC-O14
14
M&R Shop
Outfall 15
HC-O15
15
16
HC-O16
Outfall 16
Outfall 17
HC-O17
17
3A
10

Notes:
1. Monitoring wells were drilled and developed by Hart Crowser in June 2017 near the 12 potential outfalls identified by the Port of Seattle for outfall repairs.
- Stormwater conveyance system data provided by Port of Seattle (via Aspect Consulting, LLC on September 20, 2017). Additional outfalls were shown on the Port of Seattle-provided data, but were not connected to any stormwater conveyance structures. Those outfalls are not shown on this figure.
- Drainage basin boundaries were originally defined by URS Corporation in the SWPPP dated June 2010 and updated with data from the Port of Seattle. Basin boundaries have been further verified and updated by SSAT, KPFF, and Floyd|Snider through investigations conducted between 2013 and 2017. Off-site run-on does exist. Basins are based on discharge within terminal boundaries.
- Terminal 18 facility boundary is based on SSAT operations, known lease area, fence line, aerial photography, and professional judgement.
- Orthoimagery obtained from NearMap, 2017.

Abbreviations:
C.E.M. = Container Equipment Maintenance
M&R = Maintenance and Repair
SSAT = SSA Terminals, LLC
SWPPP = Stormwater Pollution Prevention Plan

0 150 300 600
Scale in Feet
N

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Terminal 18 Outfall Repair CSGP
Port of Seattle SD-04
Seattle, Washington

Figure 1a
Potential Outfall Repair Location
Monitoring Wells, North Portion

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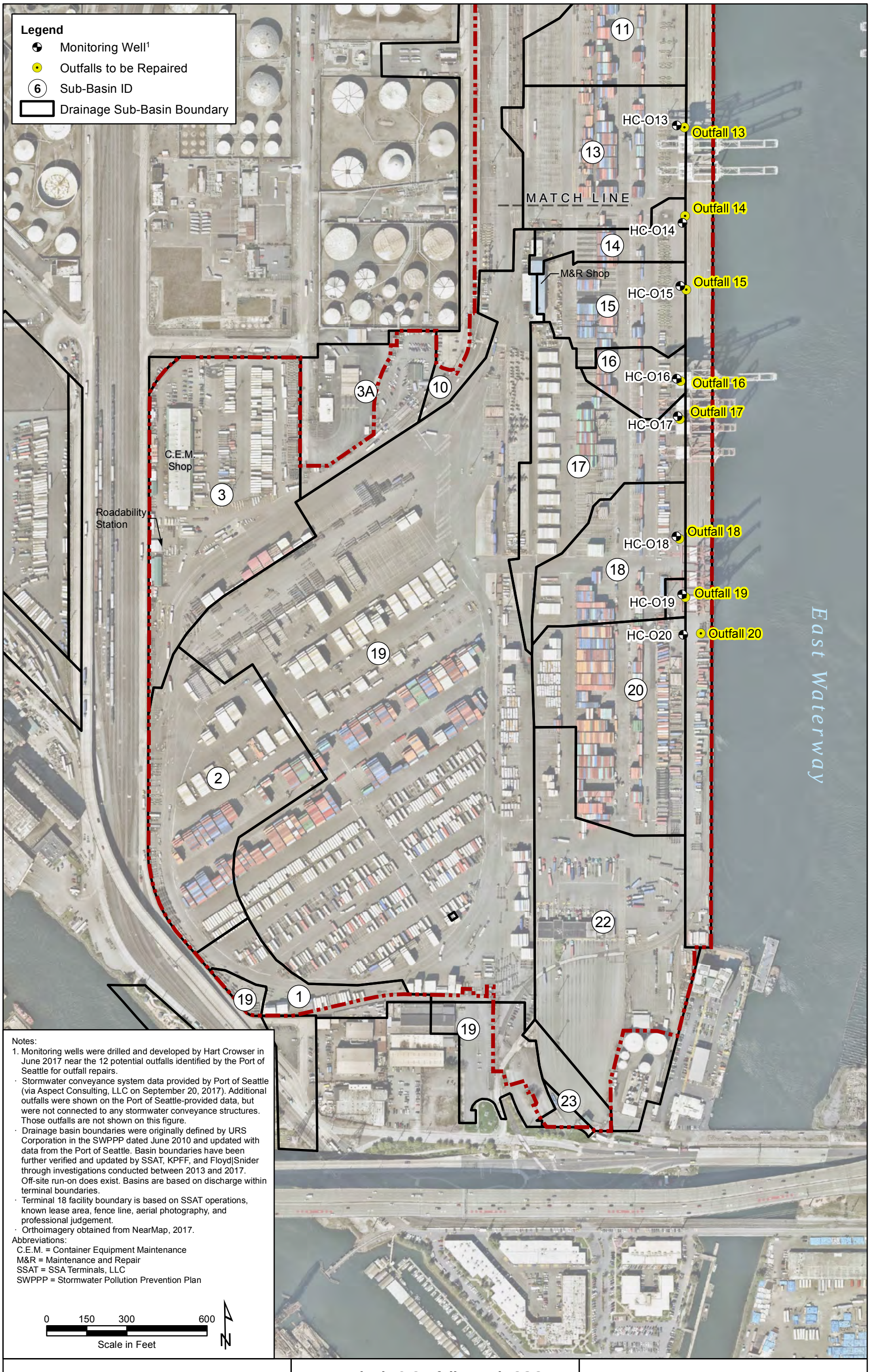

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0 150 300 600
Scale in Feet
N

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Terminal 18 Outfall Repair CSGP
Port of Seattle SD-04
Seattle, Washington

Figure 1b
Potential Outfall Repair Location
Monitoring Wells, South Portion

I:\GIS\Projects\POS-OnCall\SD04\MXD\Outfall Repair Permitting Support SAP_QAPP\Potential Outfall Repair Location Monitoring Wells.mxd 3/5/2018